

CLAIMS

What is claimed:

1. A method for mating an integrated circuit device having a plurality of conductive contacts with contact tips arranged in a predetermined pattern and extending from one surface
5 of said device to a substrate having a plurality of conductive pads arranged on one surface of said substrate in said predetermined pattern, said method comprising the steps of:
applying a layer of a first underfill to said surface of said device having said contacts extending therefrom;
partially curing said first underfill;
10 applying a layer of a second underfill to at least said conductive pads of said substrate surface;
aligning said device with said substrate such that said contacts are adjacent corresponding pads; and
subjecting said device and said substrate to a reflow process to conductively couple
15 said conductive contacts to said conductive pads.
2. The method of claim 1 wherein said first underfill applying step comprises the step of applying a filled underfill to said surface of said device having said contacts extending therefrom.
20
3. The method of claim 1 wherein said first underfill applying step comprises the step applying at least one layer of said first underfill to said surface of said device having said contacts extending therefrom; and partially curing each of said at least one layer.
- 25 4. The method of claim 3 further including the step of applying at least one layer of said first underfill to said surface of said device having said contacts extending therefrom and partially curing each of said at least one layer, wherein at least one of said at least one layer of said first underfill is selected to reduce the coefficient of thermal expansion of the first underfill.

30

5. The method of claim 1 further including the step of removing said first underfill from said tips of said conductive contacts subsequent to said step of applying said layer of first underfill to said surface of said device having said contacts extending therefrom.
- 5 6. The method of claim 5 wherein said removing step comprises the step of polishing at least the tips of said contacts.
7. The method of claim 5 wherein said removing step comprises the step of etching said layer of first underfill to expose said tips of said contacts.
- 10 8. The method of claim 5 wherein said removing step comprises the step of chemically mechanically polishing said layer of said first underfill to expose said tips of said contacts.
9. The method of claim 5 wherein said removing step comprises the step of reactively
15 ion etching said layer of said first underfill to expose said tips of said contacts.
10. The method of claim 5 wherein said removing step comprises the step of laser milling said layer of first underfill to expose said tips of said contacts.
- 20 11. The method of claim 5 wherein said removing step comprises the step of laser ablating said layer of first underfill to expose said tips of said contacts.
12. The method of claim 1 wherein said step of applying said first underfill comprises the step of applying said layer of first underfill by at least one technique selected from the group
25 of spinning, brushing, dispensing, spraying and screen printing.
13. The method of claim 1 wherein said step of partially curing said layer of first underfill comprises the step of partially curing said layer of first underfill utilizing a technique selected from the group of B-staging, soft baking, application of compressed gas, hot gas drying, oven
30 heating, UV light curing and IR baking.

14. The method of claim 1 wherein said step of applying said layer of said second underfill to at least said pads on said substrate surface comprises the step of coating at least said pads with a fluxing agent.

5

15. The method of claim 1 wherein said step of applying said layer of said second underfill to at least said pads on said substrate surface comprises the step of coating at least said pads with a curing agent.

10 16. The method of claim 1 wherein said step of applying said layer of said second underfill to at least said pads on said substrate surface comprises the step of coating at least said pads with a curing agent.

15 17. The method of claim 1 wherein said step of applying said layer of said second underfill to at least said pads on said substrate surface comprises the step of coating at least said pads on said substrate surface with a polymer flux.

18. The method of claim 1 wherein said step of applying said layer of said second underfill to at least said pads on said substrate surface comprises the step of coating at least
20 said pads on said substrate surface with an underfill with a filler load ranging from 0 to 30% by weight.

19. The method of claim 18 wherein said step of applying said layer of said second underfill to at least said pads on said substrate surface comprises the step of coating at least
25 said pads on said substrate surface with an underfill with a filler load ranging from 0 to 10% by weight.

20. The method of claim 1 further including the step of curing said first underfill and said second underfill.

30

21. The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of applying forced hot gas to reflow said conductive contacts.

5 22. The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of applying forced hot air to said device and said substrate to reflow said conductive contacts.

10 23. The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of reflowing said conductive contacts within an infra red oven.

15 24. The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of reflowing said conductive contacts in a hot bar reflow process.

20 25. The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of reflowing said conductive contacts in a hot plate reflow process.

25 26. The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of reflowing said conductive contacts in a vapor phase reflow process.

27. The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of reflowing said conductive contacts in a fume gas reflow process.

28. The method of claim 1 wherein said layer of said second underfill comprises an unfilled underfill.

29. The method of claim 1 wherein said layer of said second underfill comprises a lightly
5 filled underfill having a filler less than 30% by weight.

30. The method of claim 1 wherein said layer of said second underfill comprises a lightly filled underfill having a filler less than 10% by weight.

10